

PROGRESS REPORT -- DECEMBER 2004

Population Indices of Rainbow Smelt (*Osmerus mordax*) Spawning Runs in Massachusetts.

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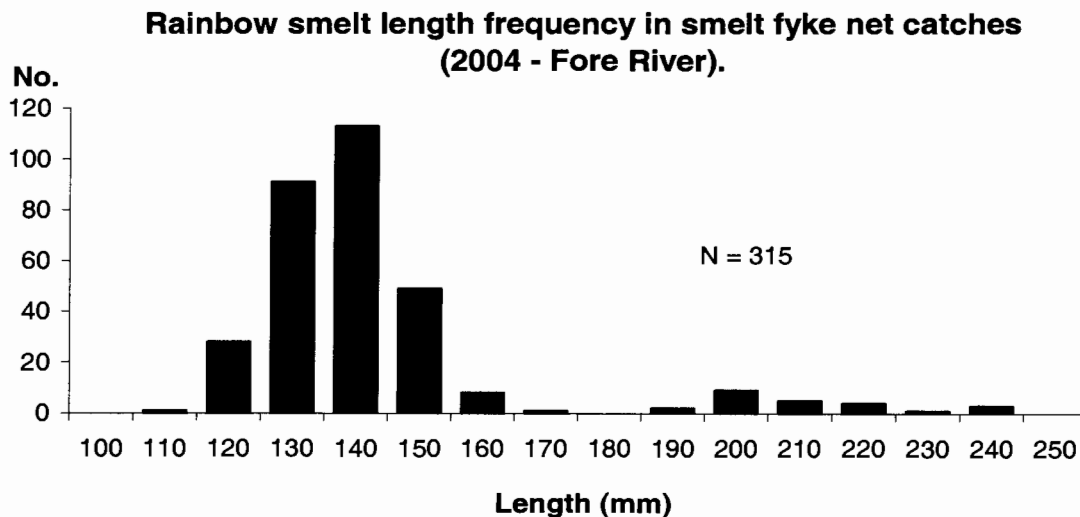
Project Objective

A two-year pilot study was initiated in 2004 to develop monitoring protocols for biological and population parameters of smelt runs in Massachusetts. The monitoring will focus on the adult smelt during the spring spawning runs and produce estimates of size composition, age composition, sex ratio, survival, total mortality and a catch per unit index of abundance. This pilot effort will result in an annual monitoring project conducted by DMF. This effort may also be useful for assisting the development of monitoring in other regions in New England, and for future sampling related to tagging experiments and marked hatchery smelt. See attached "Field Sampling and Data Collection" description for more details on methods.

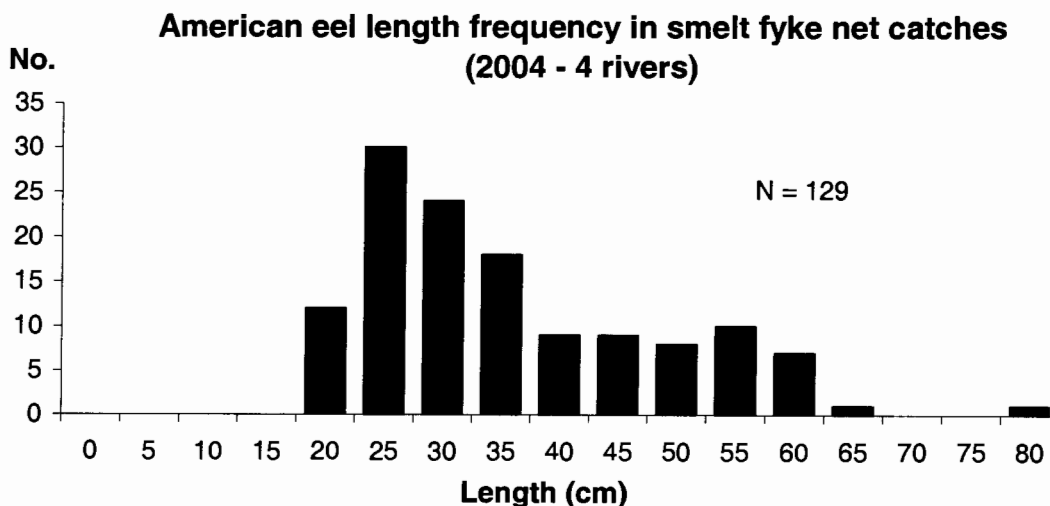
2004 Summary

Fyke nets were set for smelt in the following rivers during the period of March 7th - May 19th: Jones River (Kingston), Fore River (Braintree), North River (Salem), and Parker River (Newbury). Eighteen successful hauls were made in each river during 2003. Three sampling periods during early April were missed due to a rain storm that brought 4-6 inches of rain to the region. Smelt were caught in each river except the North River. Large numbers of smelt were only caught in the Fore River; and an age composition key was derived from these data. A total of sixteen species of fish were caught (5 diadromous, 4 estuarine, and 7 freshwater), with mummichog, American eel, and fourspine stickleback following smelt in terms of highest relative abundance (see catch tables for each river). All smelt scales have been aged and all catch data have been entered into an Access database. The following results are preliminary because analyses to date have been limited and no data auditing has been conducted.

Smelt Population Data. A total of 315 smelt from the Fore River were aged, resulting in the first age key for smelt in Massachusetts in over 20 years (table and figure attached). Age-1 smelt dominated the age composition (91%), and 77% of the age-1 smelt were mature males. No age-4 smelt were found in this sample and only 3% were age-3. These results are different from previous studies that aged smelt in Massachusetts and found that age-2 smelt comprised a majority of the spawning run and had higher percentages of age-3 and age-4 smelt. All smelt scales were aged by at least two readers, with high agreement among readers ($\geq 95\%$).



Other Catch Data. The fyke net catches provided useful data documenting the presence of four additional diadromous species and providing catch and size data for American eel and Atlantic tomcod. These are two species that we are concerned over their population status but have little data for Massachusetts populations. Eels were uniformly present in each river (found in 6-8 hauls, late-March through May) for each river with a wide range of juvenile and adult sizes (figure attached).



Project Costs in 2004. Project costs applied to the NMFS grant were \$8,531 in 2004 (listed below). This sum is below expected costs because the technician was hired over a month later than planned due to administrative delays. Division of Marine Fisheries in-kind contributions exceeded the grant expenses (ex. PI hours ~ 450 hours; water chemistry instrumentation expenses ~\$2,500; field and lab. supplies ~\$500; and gas for vehicle travel ~\$700).

Technician	(508 hours)	\$6604
Memphis Net and Twine	(fyke nets)	\$1280
Building Center	(hardware supplies)	\$ 87
Fisher Scientific	(ageing supplies)	\$ 210
Forestry Supply	(waders and field supplies)	\$ 350
Total		\$8,531

2005 Season Expectations

Planning will soon commence for the 2005 monitoring season. The same four rivers will be monitored again and the Saugus River (Saugus) will be added through a cooperative agreement with the National Park Service at the Saugus River Iron Works that will add no cost to this project. The fyke net dimensions will be altered for 2005. The net used in 2004 was relatively small out of concern for catching too many smelt. In practice, I believe that the low catches in the Jones and Parker rivers and lack of catch in the North River were influenced by the small net size relative to river width. In each of those rivers we documented upstream smelt egg deposition that should have corresponded to higher catches. Following a review, the fyke net wing length and height and hoop number and height will be increased. We will also explore setting the net for a third night each week. It is a concern that two sets a week may not capture a representative sample of the spawning run. Sampling four or five nights a week would greatly enhance the catch data, but will not be possible without hiring a second technician. Project costs will increase in 2005 with the new nets, earlier hiring of the technician, and water chemistry instrumentation costs will be drawn from the grant this season.

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Smelt Fyke Net Catch Data: 2004

Location: Fore River, Braintree (18 hauls)

Species Name	Scientific Name	Type	Total Catch (No.)	Frequency of Occurrence (No. of Hauls)
rainbow smelt	<i>Osmerus mordax</i>	Diadromous	689	12
American eel	<i>Anguilla rostrata</i>	Diadromous	39	8
Atlantic tomcod	<i>Microgadus tomcod</i>	Diadromous	14	5
mummichog	<i>Fundulus heteroclitus</i>	Estuarine	1	1
fourspine stickleback	<i>Apeltes quadracus</i>	Estuarine	13	6
threespine stickleback	<i>Gasterosteus aculeatus</i>	Estuarine	4	4
winter flounder	<i>Pseudopleuronectes americanus</i>	Estuarine	2	2
bluegill	<i>Lepomis macrochirus</i>	Freshwater	2	2
banded sunfish	<i>Enneacanthus obesus</i>	Freshwater	1	1
redfin pickerel	<i>Esox americanus americanus</i>	Freshwater	2	2
sand shrimp	<i>Crangon septemspinosa</i>	Arthropod	1	1
Total Fish Catch			767	

Location: Jones River, Kingston (21 hauls)

Species Name	Scientific Name	Type	Total Catch (No.)	Occurrence (No. of Hauls)
rainbow smelt	<i>Osmerus mordax</i>	Diadromous	22	6
American eel	<i>Anguilla rostrata</i>	Diadromous	17	8
white perch	<i>Morone americanus</i>	Diadromous	1	1
mummichog	<i>Fundulus heteroclitus</i>	Estuarine	3	2
fourspine stickleback	<i>Apeltes quadracus</i>	Estuarine	2	2
yellow perch	<i>Perca flavens</i>	Freshwater	42	8
sand shrimp	<i>Crangon septemspinosa</i>	Arthropod	1	1
green crab	<i>Carcinus maenas</i>	Arthropod	10	5
Total Fish Catch			87	

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Smelt Fyke Net Catch Data: 2004

Location: Parker River, Newbury (18 hauls)

Species Name	Scientific Name	Type	Total Catch (No.)	Frequency of Occurrence (No. of Hauls)
rainbow smelt	<i>Osmerus mordax</i>	Diadromous	3	1
American eel	<i>Anguilla rostrata</i>	Diadromous	46	6
lamprey	<i>Petromyzon marinus</i>	Diadromous	3	3
mummichog	<i>Fundulus heteroclitus</i>	Estuarine	3	1
fourspine stickleback	<i>Apeltes quadracus</i>	Estuarine	82	15
threespine stickleback	<i>Gasterosteus aculeatus</i>	Estuarine	22	6
white sucker	<i>Catostomus commersoni</i>	Freshwater	1	1
pumpkinseed	<i>Lepomis gibbosus</i>	Freshwater	2	2
banded sunfish	<i>Enneacanthus obesus</i>	Freshwater	3	3
golden shiner	<i>Notemigonus crysoleucas</i>	Freshwater	1	1
yellow bullhead	<i>Ameiurus natalis</i>	Freshwater	2	1
green crab	<i>Carcinus maenas</i>	Arthropod	1	1
crayfish		Arthropod	1	1
tadpole		Amphibian	1	1
Total Fish Catch			168	

Location: North River, Salem (18 hauls)

Species Name	Scientific Name	Type	Total Catch (No.)	Occurrence (No. of Hauls)
American eel	<i>Anguilla rostrata</i>	Diadromous	33	8
threespine stickleback	<i>Gasterosteus aculeatus</i>	Estuarine	24	8
fourspine stickleback	<i>Apeltes quadracus</i>	Estuarine	5	5
mummichog	<i>Fundulus heteroclitus</i>	Estuarine	197	16
redfin pickerel	<i>Esox americanus americanus</i>	Freshwater	2	2
golden shiner	<i>Notemigonus crysoleucas</i>	Freshwater	2	2
Total Fish Catch			263	

Age composition of rainbow smelt (*Osmerus mordax*) sampled during the 2004 spring spawning run in the Fore River, Braintree, Massachusetts.

	Age	N	%	Total Length Mean (mm)	Total Length Variance	TL, Range	Mean Wt. (g)
TOTAL	1	288	91	133	85.3	106 - 161	12.7
	2	19	6	186	739.4	129 - 212	39.2
	3	8	3	222	207.0	197 - 237	71.9
	<i>Summary</i>	315	100	139	465.9	106 - 237	15.8
MALE	1	223	94	133	71.0	113 - 156	12.6
	2	11	5	182	848.7	145 - 208	38.6
	3	3	1	209	132.3	197 - 220	59.6
	<i>Summary</i>	237	100	136	283.0	113 - 220	14.4
FEMALE	1	65	83	135	129.5	106 - 161	13.4
	2	8	10	191	746.0	134 - 212	40.7
	3	5	7	223	359.8	188 - 237	71.9
	<i>Summary</i>	78	100	147	933.8	106 - 237	20.3

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Population Indices of Rainbow Smelt (*Osmerus mordax*) Spawning Runs in Massachusetts.

Field Sampling and Data Collection (March 2004)

Sampling Period. March 8th - May 15th.

Fyke Net. Five hoops (0.6 m or 2 ft. diameter) over a length of 2.5 m with two throats to contain fish. One meter wings are attached on both sides. All meshes are 0.64 cm (1/4 in.). Wing poles will be set 1.8 m apart, although this can be adjusted based on water velocity.

Net Deployment. The fyke nets will be set overnight and retrieved early the next morning. For each river, a mid-channel location will be selected and used for each deployment. Sample dates will not be randomly selected because of the complexity of coordinating traffic, tide and other tasks. Both the setting and hauling of nets must be done at lower tides; therefore these criteria will be most important for scheduling deployments. Two overnight sets will be made each week (10 weeks, 20 sets)

Sampling Stations. Jones River (Kingston), Fore River (Braintree), North River (Salem), and Parker River (Newbury). The sampling stations are located at the lower end of spawning habitat where tidal influence is present.

Catch Processing. Empty the net cod-end into buckets. Separate a random sample of smelt (up to 50) in a bucket for age/sex subsample. Measure (TL, mm), sex, and release the remaining smelt up to 100 individuals. Count and release the remaining smelt. Measure and release all other species. Measure no more than 30 mummichogs or sticklebacks.

Field Data Recording. Record the time the nets soaked (nearest 0.25 hour), tide stage, moon stage, and water chemistry from YSI 6820 (temp., pH, conductivity, D.O., and turbidity)

Age/Sex subsample. The smelt sampled for scale collection and sex should be proportional to the number of smelt in each length class. This can be achieved by randomly mixing a subsample from the collection bucket. No scales will be collected when less than 20 smelt are caught and up to 50 smelt will be aged per set. An exception will be made for very large catches (+200 fish). In this case, a fixed stratified subsample of 10 fish per cm per gender will be selected. An age-length key will be derived for each set.

Laboratory Processing. Following net collections, the smelt will be processed that day in Gloucester. The following data will be collected: sex, maturity, total length, fork length (2004 only), weight (2004 only), and scales. Females caught in March will be frozen for fecundity analysis, and a subsample will be frozen each month for future genetic analysis.